ABSTRACT

Disclosed is a ceramic or metal single-crystal material having high-density dislocations arranged one-dimensionally on respective straight lines. The single-crystal material is produced by compressing a ceramic or metal single-crystal blank at a high temperature from a direction allowing the activation of a single slip to induce plastic deformation therein, and then subjecting the resulting product to a heat treatment. The single-crystal material can be used in a device for high-speed dislocation-pipe diffusion of ions or electrons. The single-crystal material can further be subjected to a diffusion treatment so as to diffuse a metal element from its surface along the dislocations to provide a single-crystal device with a specific electrical conductivity or a quantum wire device. Otherwise, the single-crystal material can be subjected to annealing or chemical etching so as to form nano-holes along the high-density dislocations to provide a thin film device, such as a molecular sieve film or a carbon-dioxide separating film.